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ABSTRACT

This paper provides a background of the development of hypermedia technology and describes a hypermedia system that could be used to teach probability and statistics through a web-based interface. (Contains 30 references.) (Author/WRM)

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HYPERMEDIA SYSTEM TO TEACH STATISTICS

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ABSTRACT *- Teaching courses that require a high mathematics background is not an easy task. This happens because the majority of the students do not like anything that includes a lot of numbers. The reasons for this are multiples. Many studies have already tried to identify the causes why many students of all areas fail to get approved in undergraduates' courses like Calculus, Linear Algebra, Analytic Geometry, Probability and Statistics. In engineering areas the reasons are not exactly the lack of appreciation of Mathematics, however the problem seems to be the same [CUR92, CUR95, FER91, MOR90].*

After the success of the computers in all areas, including learning, and the fantastic growth of Internet and WWW, new and more effective ways are attracting students and arising their enthusiasm to study any subject. However, the enthusiasm is not enough (the majority of the students have a poor background in mathematics), but we can take advantage of their interest and disposition to reinforce the weakness of their math formation. The best way to do this, I believe, is to use a system that includes WWW and Internet. The majority of students are familiar with the WWW and its interface, thus it is a waste of time using some other system where the students need to know everything from the beginning.

This work presents a hypermedia system to help teach Probability and Statistics driven by Internet and using WWW as a tool, where the user can take the subjects from a browser in a dynamic and attractive way. The system has associated auxiliary resources to help the user understand better the contents. He or she can performing simulations, visualizing charts in a dynamic way, performing calculations using a spreadsheet and communicating with the teacher or colleagues (by e- mail) and, to sharing and discussing doubts (by chat).

1. INTRODUCTION

In the mathematical and statistical area the instruction is made mainly through lectures. The main effort is realized by the teacher, having the student a passive and not participant attitude. Most of what is taught by the teacher is not learned due to the students are not captivated by the subject being taught; there is to much information to assimilate; there is not enough time to reflect about the subject, and examples, etc. The students have few exercises to practice on and can not experience by themselves how "things works".

Teaching college Statistics and having seen this picture for almost twenty years I am proposing a new approach aiming to increase the performance of both the students and the teacher. This approach intends to join the state-of-art on presenting information represented by hypermedia systems with the state-of-art in software construction represented by the object-oriented paradigm, including techniques like dynamics graphics and simulation. I am not proposing a new CAI or similar system where the student needs to face rules and commands which are not standard and consequently has to expend a lot of time to understand how the system works. The proposed system is similar to any Internet browser and yet includes facilities to teach, in this case, Statistics. These facilities include the standard e-mail and chat but also a spreadsheet to work on statistical calculations, a text editor to allow the teacher made corrections in the material being taught and additional programs to perform simulations of probabilistic and statistics experiments. The system is also multimedia, that is, it can include sound, video, animations and any other program to be run by links inside the subject being taught.

2. EDUCATION AND COMPUTERS

The construction of ENIAC (**E**lectronic **N**umerical **I**ntegrator **A**nd **C**alculator) at Pennsylvania University during the World War II was the landmark of the computer era. The transistor invented in 1948 and integrated circuits in the fifties made possible the development of microcomputers in the earlier seventies. These computers were each time smaller and cheaper but also more powerful and efficient. They have opened new horizons in all areas including personal and educational.

The software has followed the improvement in hardware. In early times the programs and data were batch processed by punch cards with the results returning also in batch way, normally by printer. After the 'mouse' invention and improvement in input systems, like the keyboard, and the development of the high level languages, the computers have become more and more interactive showing its potential in the educational area, once the results could be seen promptly on the monitor screen allowing an immediate feedback.

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The computers based learning systems named CAI (**C**omputer-**A**ided/**A**ssisted **I**nstruction), CAL (**C**omputer-**A**ssisted **L**earning), CBE (**C**omputer **B**ased-**E**ducation), CBI (**C**omputer-**B**ased **I**nstruction) CBL (**C**omputer **B**ased-**L**earning), CBT (**C**omputer **B**ased-**T**raining) or CMI (**C**omputer **M**anaged **I**nstruction) started to appear on late fifties and we can point several phases in their development. Each one was marked by software and hardware requirements as well learning theories.

The first phase of CAI, 1958 to 1961, was mainly characterized by hardware difficulties like how to connect terminals, slides projectors and others mechanism of input/output in to computers aiming interactivity with the user [VEN91]. In these pioneers programs the information was presented in short and easy stages to allow reinforcement in all answers to minimize the number of errors. According to Skinner, the gradual presentation of contents helps the students to dominate progressively more advanced knowledge.

In the second phase, 1962 to 1967, many new projects have appeared granted by military and governmental American funds. Among these systems are CLASS, SOCRATES and SAID.

The third phase was characterized by big projects, in particular PLATO and TICCIT, that have received many resources and publicity, but few critical evaluations. In the seventies appeared the generative systems, which could generate all or part of the instructional material automatically. It was at this time also that the ITS (**I**ntelligent **T**utorial **S**ystem) was created. These systems consist of the application of techniques of AI (**A**rtificial **I**ntelligence) over the well known CAI systems and they are called as ICAI (**I**ntelligent **C**omputer **A**ssisted **I**nstruction) [KEA87, SEL88].

The penultimate phase began in 1977 with the manufacture of the first microcomputer and remains until the Internet popularization in 1992. This phase is marked by a new interest in produce CAI systems. These softwares are now improved by including warning error, showing the correct solution and making hypotheses about the students trying to show the misconception. However most of them are tutorials and are restrict to particular domain [CAR92].

The last phase could be pointed as starting in 1992 with the release of the first WWW browser and consequently with the huge development of the Internet. In this era we can see a change in the educational paradigm. Now is not more necessary a room, chalk, blackboard and a teacher. With the Internet and the new resources a student can stay in any place in front a computer and interact with the teacher, get the lessons, exercises; tasks without worried about schedules, rooms or where the teacher is.

THE COMPUTER AND LEARNING THEORIES

Many learning theories have been developed in the efforts to understand the learning process and to make it more effective. The use of computers in the learning process varies according to the pedagogical theory involved. Today the cognitive approach to learning is more accepted. It emphasizes the concept of structure - the cognitive - to explain the learning process. Each person has a mental model of its environment, based in his or her experience. He or she learns when reorganize his or her cognitive model incorporating the new information in a process called insight. In this reorganization the teacher so as the student perform an active function. The teacher takes advantage of the student previous experience and tries to make analogies between the new information and the one that the student already knows. In this model the teacher takes the main role, however is the student the task to reorganize his or her previous knowledge [CHA80].

Another learning approach is centered in the learner's choice and it is named, sometimes, **exploratory learning**. This approach is based in assumption that the learner knows how to control efficiently his or her learning process. No hypotheses are made about how the apprentice learn. Thus, this approach could be considered the opposite of the cognitive approach because this let the learner by himself/herself, which in the cognitive the teacher assumes the main role.

Based on this two learning theories it is possibly to classify the computer usage in the educational area in three ways. Two of them being a directly result of the learning theories applied in the computer domain, that is, one trying to replace the professor (the computer as a **tutor**), and the other, transferring all the efforts over the student (the computer as a **tutee**). The third way could be a neutral form, where the computer will be a **tool** [PAG92, ROM90].

The computer as a tutor. In this approach the computer helps to show new contents through drill-and-practice and tutorials. The computer is a teacher and the knowledge source to the student. The computer can execute many tasks to drill the student in matters where the factual knowledge is necessary, bring him or her through a knowledge domain, as the Statistics, for example. It put appropriate questions in each step and evaluates the student before following to more complex issues.

The computer as a tutee. The computer is driven by the student. It can perform a more passive role in the sense that is the learner who decide which way he or she have to follow to understand the matter in a particular domain. The learner has a complete freedom of action and a constant interaction with the computer.

The computer as a tool. In this approach the computer helps the student but do not drive his or her efforts. The computer is only an instrument to help the student realize a task, like a word processor or a spreadsheet. The learner can work in a more efficient and transparent way.

3. HYPERMEDIA

The text is one of the most popular forms of store knowledge and transmits ideas. However, in normal usage it is a communication way strictly linear (or sequential). If a text is organized and processed in a non-linear way it is called hypertext [BAR89]. A hypertext system is made of connected chunks of text.

The hypermedia paradigm is essentially a generalization of the hypertext concept where besides text, others media (text, figures, animated figures, sound, video and another programs) are added, that is, a hypermedia system is a multimedia hypertext. However, the opposite is not always true, some multimedia systems are not hypermedia systems.

HISTORY

Vannevar Bush is normally considered the hypertext pioneer. Its system Memex (**Mem**ory **ex**tender) [BUS45], was never implemented, but besides that it is considered the first system to incorporate the main characteristics of hypertext. The paper appeared in 1945 and before it nothing more occurred in this area for approximately twenty years. People was busy trying to improve computers and made them interactive, but they were so expensive that many financial project bureaus take how completely irresponsible the idea that they will used in other tasks but numerical as processing text. The term hypertext only appeared in 1965, in a first real system of this kind built by Ted Nelson.

MAIN PIONEERS SYSTEMS

Memex (1945). The paper entitled "*As we may think*"; describing the system appeared in 1945 in the *Atlantic Monthly* magazine. His system had proposed several of the most important ideas on hypertext including links.

Augment/NLS (1962-1976). This system was the first great work in the area of office automation and word processing. It was developed at SRI (*Stanford Research Institute*).

Xanadu (1965). Ted Nelson was one of the hypertext pioneers with his system Xanadu. He intended to build a database for all knowledge in the world, however his intention was never realized.

Aspen Movie Map (1978). This is maybe the first hypermedia system. It was developed at MIT and it is a simulation of a trip to city of Aspen.

KMS (1983). The KMS (***K**nowledge **M**anagement **S**ystem*) is a direct descendent of the early system ZOG developed at *Carnegie Mellon* University in 1972. It is a commercial product since 1983 and it was used in many applications, including project management, technical manuals and electronic publishing.

Hyperties (1983). Its beginning was a research project at Maryland University conducted by Ben Shneiderman. It is a commercial product since 1987 and marketed by *Cognetics Corporation*.

Notecards (1985). Developed at Xerox PARC aimed to help in tasks like: information analysis, including reading, categorization and technical writing. It is one of the best-known hypertext systems in the research area due to its well-documented project.

Symbolics Document Examiner (1985). This hypertext was build not to prove that this technology was a reality but to do a real work. Beginning in 1982 it was finished in 1985 and was the first hypertext system to do a real job serving as an interface to the online documentation of the *Symbolics* workstation [NIE95].

Intermedia (1985). This system was a result of the one of the older research team in hypertext area. The IRIS (***I**nstitute for **R**esearch in **I**nformation and **S**cholarship)* group from Brown University. Some of the most innovative hypertext systems were developed in this place under the Andries Van Dam leadership, including the first Hypertext Editing System (1968), the FRESS (1969-1982), and the Electronic Document System (1982).

Guide (1986). First commercial hypertext system to be launched for the Mac platform. It is still today one of the only system working in Mac and Windows versions.

HyperCard (1987). Created by Brian Atkinson. In the beginning was not as a hypertext but a graphical programming environment. But despite that this system is one of the best known hypertext in this days, maybe due to the marketing strategy of the Apple computer that sold every Mac, after 1987, with a copy of the system without any additional costs.

HYPERTEXT - ADULT AGE

Several hypertext systems were annunciated in 1985 and after this epoch its use spread out. The final impulse by its popularization was in 1987 when the Apple computer introduced the HyperCard. To summarize it can be said that the hypertext was idealized in 1945, was born in 1960, raised slowly in the seventies and finally have its development in the eighties with a particularly rapid growth after 1985 and, having been fixed definitely in the year of 1989 [NIE95].

HYPERTEXT/HYPERMEDIA ARCHITECTURE

There are many kinds of architecture found in hypertext/hypermedia systems. To classify them is not an easy task, due to a variety of software/hardware platforms and a diversity of objectives. If we let aside these considerations then it is possible to point out some commons frameworks:

Presentation level: User interface.

HAM (Hypertext Abstract Machine). Links and nodes.

Storage level: Database.

4. THE INTERNET AND WWW

The Internet had its beginning in an American military organization ARPA (Advanced Research Project Agency) in the early sixties. It was follow by

the NSFNET created after DARPA (old ARPA) decided to give up its support, by NSF (National Science Foundation) e since then the Internet main via.

THE WWW PROJECT

The birth of WWW (World Wide Web), W3 or Web was in CERN (Centre Européen pour la Recherche Nucleaire), the European Laboratory of Nuclear Physics, in 1989, when Tim Berners-Lee suggested a project to integrate the Internet, the hypertext and the multimedia. In July 1992 was released the development library to the WWW and after that it was possibly to develop browsers and servers that put the Web in to life. The pioneer was Mosaic multiple platform software that explored all the hypermedia capacity of the net. After the Mosaic released the Internet began an explosive growth. In autumn 1993 millions of new users started to navigate with the Mac and Windows releases.

The Web follows, essentially, the 3 level archicteture. The bottom level, the database, is made by the Internet, that are, all the computers connected around the world supplying material to it. These computers are servers and the users do not need to know where they are located, or what kind de hardware or software they are made or even so which kind the internal engine to storage data they are using. All of them serve data in HTML format through a standard protocol the HTTP. The combination of HTML language and HTTP protocol form the second level, the hypertext abstract machine and this is the only point that the computers server and client have to agree. The presentation level (third level) is managed by the client visualizer running in a client machine, that is, by the browser. One of the WWW characteristics is that a number of different browsers are available supplying an unequal set of facilities to attend the users needs. However, this browsers, in spite of its powerful navigational capacities, are not and were not made with the specific aim to serve as a teach base and, because of that they do not have abilities to do that.

The majority of improvements related to technology are incremental and evolutionary. Nevertheless, sometimes, appears a new technology that quakes all the industry. The WWW is certainly one of this kind of technology [DAV96]. The WWW represented to the Internet the same as the telephone represented to the telegraphy. Before it the Internet had a powerful international medium of exchange information, but it was not easy to use and for that accessible to a few persons. The early users of Internet had to dominate a profusion of programs like ftp, telnet, etc, each one with a different interface, with particularities and peculiar commands. With its Windows interface the WWW standardized and ordered the latest confusion. The user can navigate with the browsers between sites without worry about which kind of computer are being accessed. With the standardization anyone can easily look for any kind of information, download sound and video hear music or order a pizza.

THE HTML LANGUAGE

The HTML was designed to specify the logical organization of text documents with extensions to include images and links to other documents or resources on the Internet. The aim was made it independently of the hardware platform or software environment representing the logical framework of the document and not its presentation. This means that in a shared environment the person interested in visualize a document can use any kind of hardware and different visualizers or browsers. For example, the language does not specify that a certain text must be viewed in a Times Roman font with a 14 size, because depending of what hardware are being used that had no value. For this reason the language does not specify typewriting details of a document, but instead, marks the logic structure, defining paragraphs, headers, titles, list, tables, etc. The presentation details are let to the browsers.

HTTP - The first HTTP (HyperText Transfer Protocol) was established in 1991 and set up the information transfer method through the Internet. The protocol uses the conventional stile of file transfer in the Internet, the telnet connection by TCP-IP. The client asks a TCP-IP connection with a host using a DNS (Domain Number System) or an IP number specifying a port number. The server accepts the connection. The client sends a requisition and the answer is an HTML message, that is, a byte flux of ASCII characters. The message is ended by closing the connection with the server as soon as all document is sent.

BROWSERS - The browser was the software responsible by the true explosion in the growth of the Internet. Many of the Internet resources existed before, but to use them was necessary knowing a profusion of different programs which one based on a specific hardware platform. The browsers and HTTP/HTML protocols ordered this apparent chaos putting all these softwares togheter in a standard way. Therefore, who wants to use the Internet does not have to be an expert or know a profusion of commands of all kinds of computers, all we need to do is point and click with a mouse.

These are some of the characteristics of a browser:

- Mouse oriented graphical interface.
- Support to hypermedia documents.
- Display text in a variety of fonts (bold, italic, underline, etc.).
- Sounds support (Macintosh, Sun audio, and others).
- Video support (AVI, MPEG e QuickTime).
- Display ISO 8859 characters (can show accent).
- Interactive electronic formulary support.
- Interactive graphics support (GIF, XBM e JPG).
- Sensitive images support.
- Hypermedia links and web services support (ftp, telnet, nntp, etc.).

How the Web works?

The Web works following the popular model client-server. A Web server is a program designed to serve (to send) documents to the clients by requisition. A Web client is an interface that request documents to a server specified by the user. 1. Using a **browser**, the user clicks on a link; 2. The Web client connects to the computer specified in the URL and asks the server the document. 3. The server answer sending a text or other element in the document (graphs, sounds, films) to the user's screen.

Client and server communicate using the HTTP protocol. All clients and servers need to "talk" HTTP because without that it is not possible to send and receive hypermedia documents. The WWW acronym is used to indicate a set of nets and servers that understand HTTP and a collection of global information shared through this protocol. The standard language used by the Web to create and recognize hypermedia documents is HTML which is a derivation of SGML (**S**tandard **G**eneralized **M**arkup **L**anguage). The HTML documents are nothing more than ASCII files including links and format code about its layout (text stiles, document title, paragraphs, lists, tables, etc.). The links in the HTML language are represented trough an URL (**U**niform **R**esource **L**ocator). Almost all services in the Internet can be represented by an URL, following the general format above:

Service://computer_name/path_name.

The service shows the protocol utilized to get the data, for example: ftp. The most common service used to navigate the Web is the http. When someone navigates from one site to another is using this service. The file service is used to load a file directly from the computer hard disk instead of the Internet.

5. WWW AS A LEARNING RESOURCE

The Internet supplies an extremely flexible way to distribute information and allows the user to access the material through a number of hardware and software platforms at any time. The contents can be reached instantly without the intermediate stage of press and distribution of the printed material. Nowadays, whichever printed material are first processed in a computer and then printed. To present the material by Internet means to cut stages and as a result to reach the user more quickly. Once a material is printed (a book, for example), it is not possible to correct the inevitable errors. With the material presented in a virtual way, the correction and update can be realized in the same moment that we find and error. Therefore having the material daily revised and updated is a good reason to use this form of communication.

The interactive capacity of Internet can increase the relation between student and teacher and among students in a variety of ways. This feedback is important to change or improve the contents, which are being presented. Also, the multimedia capacity allows not only a more enthusiastic presentation but also a better adequacy to different styles of learning. An HTML document is similar to a traditional lecture class employing transparencies. Using an HTML document means to change the nature of the communication in media terms and also in presentation format because it is possible to combine a browser with a videoconference or a sound speech [DYB94].

Limitations

The great advantage of WWW in teaching is that a material can be spread out around the world. The students can be in any place. It is necessary some additional resources for the WWW to be effective in education. The hypertext is a useful tool to be recovered from any place by a computer, meanwhile the embedded links that made this possible can be a disadvantage to be printed or changed since the document can be printed but the links not. For this reason the links by themselves must not be part of the learning material.

Learning by doing is one of the best learning methods, in this way, high level didactic material must be multimedia and interactive. Simulations and multimedia presentations are an excellent way to provide that material. However, support to embedded images in the WWW is not enough to include all the existent formats. The lack of embedded audio, video and animation into the documents requires additional programs to run (external viewers or plugins). The disadvantage of this approach is the lost of interface uniformity and hypertext functionality. The link is lost in the moment that external viewers are called. When the external software takes the control the user cannot follow any link from the node that had called the program running [KNI96].

6. THE OOP PARADIGM

The OOP (Object Oriented Programming) paradigm had begun with de simulation language Simula developed in 1967 by the researchers Birtwistle, Dahl, Myhrhaug and Nygard [BIR79]. It grows with the Smalltalk development, in 1972, by Goldberg and Robson and had its maturity with the development of C++ by Bjarne Stroustrup in 1982.

In the fifties became evident the need to have a language and a methodology to programming computers. In this time the computers were mainframes restrict to big companies and universities. The first languages of this time like Fortran and Algol were restricted to Engineering applications and mathematics processing. The programmer job was difficult due to the machine dependency. With the increase of computer utilization in the sixties, new languages appeared trying to distanciate the programmer and the computer. In decade final the software industry faced a crisis as a consequence of the low productivity and the constant need to "reinvent

the wheel". The seventies have brought new breadth to programming task with the emerging of the structured programming. It proposed the decomposition of a problem in modules. Each module is programmed following algorithm abstraction, that is, the whole system works as a result of the interaction of its parts.

Figure 1 – Structured Analysis versus Object-oriented analysis

In spite of its intensive use the structured approach shows a series of weakness like low flexibility to changes, low reuse of generated code and, difficulty to maintain this code [COAD91]. In the Object Oriented programming these problems do not exist because data and procedures are integrated in only one element that is called object. Figure 1 shows the two approaches.

ADVANTAGES OF OBJECT ORIENTATION

The OO mechanism is based in an interchange of messages in an execution of methods related to them. Then when an object receive a message it executes the associate method (generally manipulating the internal parts of its class not accessible to others outside the hierarchy) and return the result to the sender. The analist with the OO paradigm, can face better the complexities, produce more small systems than the traditional formulated and increase considerably the reuse of code and, finally, the written code is easier to maintain [BOO91, FIR93]. The combination of these characteristics make the OO paradigm more suitable to treat with the programming of complex objects like these found in hypermedia and then the natural choice of this work.

THE OBJET ORIENTATION AND THE HYPERTEXT

The OO paradigm is more adequate to represent the problem domain by entity abstraction of real world as objects or classes. Many object-oriented characteristics of analysis, design and programming can be extended to hypertext:

1. The nodes can be compared to atomic objects representing primitive data like integers, char, strings, video frames and bitmaps.

2. One link can be represented by a set of at least two object identifiers.

3. One hypertext compound node can be treated like a compound object or a set of more basic objects.

4. The encapsulation concepts can be applied by defining methods to create, destroy, update e manipulates nodes and links, to follow links and trigger events.

5. The nodes and links could be put together under different classes based on behavior or structured patterns (semantic). The semantic organization of nodes and links helps in handling better the net, eliminate ambiguities and clearly separate aims and objects.

6. The nodes and links of a particular class can also heritage proprieties of a related superclass. This characteristic can be used in creation and management of hypermedia templates, that is, if the user changes the father model, this changes are extended to all subclasses based on that template (model).

7. The proprierties of nodes and links must be always changed this can be easier done by an evolution squema.

THE IMPLEMENTATION LANGUAGE

The Pascal language was designed in 1972 by Niklaus Wirth and was named after the French scientist and philosopher Blaise Pascal. It has some new characteristics since it was designed to be a teaching language, but due to its facilities became it a popular programming language. A new programming language by itself was enough in DOS times, that is, textual programming, but in times of GUI and Windows only a language means not much. The reason is that programming Windows is in good part made by event occurrences that do not involve directly code in the subjacent language. It is necessary a lot more than a grammar and syntax to treat with these graphical systems (like Windows). Fortunately, togheter with the evolution of object the oriented programming have emerged the visual environments of programming or the also called RAD (**R**apid **A**pplication **D**evelopment). In these environments one can find not only a language but also a complete set of tools to develop professional look systems in short period of time.

7. THE PROPOSED SYSTEM

The SHEE system was developed under Windows 95 platform, incorporating a great part of new softwares metaphor of the system, presenting a wide variety of menus, keyboard shortcuts, clickable buttons, etc.

The system is using the SDI (**S**ingle **D**ocument **I**nterface) technology, that is, presents only one window at a time in the screen, avoid in this way the jam of windows that could confuse most students do not habituated to work and study on computers. This does not mean however, that it is impossible to present different pages on screen but that is made one window at a time.

Running the program the user can get immediately three different environments. The first is a browser, that is, an HTML interpreter. In this window the user can view documents like showed in any other browser. These documents can contain links to images, videos, sounds and programs. All these links are executed directly by the system without any external viewer how occur with the others browsers. In this screen the user can also view tables or even submit requests to a server. The browser can be configured to show different fonts, colors or backgrounds. It has also a list of the last visited nodes (an historic list) through it the user can go back or forward at any step of his or her path.

The second page is a spreadsheet able to exchange data with others in the market. In this page the user can open files from the browser, from the hard disk, or from the Internet. He or she can also made statistics calculations and also plots a good set of two and three-dimensional graphs and diagrams. Tables or data on the browser can easily carried to the spreadsheet where the user can perform statistics calculations or plot a diagram, which he or she wants.

The third window is a text editor where the author can view the document font, that is, HTML code. It is also possible to open others kinds of files in this page. The intention of this environment is to allow the author to do little corrections in the material practically online, because, if the user had a document opened in the browser, he or she can exchange to editor page and open the same document in a font format. After make the necessary corrections or changes in the file and save it the user can return to the browser and reload the document to see how the changes look on the navigator. This page is really a compound page made by a text editor, a graphic editor, e-mail and chat environments.

The graphic editor is made mainly to show probabilistic functions like: the graph of normal and exponential curves and others and to run simulations of the main probabilistic distributions and user defined distributions.

In the e-mail page it is possible to send or receive messages. The intention is to facilitate the communication between the teacher and the student and among students. The user can open this environment by clicking in a menu item, in a button or in a link in the browser.

The chat page has the same purpose of the e-mail page, but can connect teacher and student online by the time that he or her is facing some difficulties. If the teacher is not connected, the student can try to chat with some colleague to solve doubts.

8. CONCLUSION

With the fast growing of knowledge and technology being better each day it is not possible to ignore resources like computers to help the teaching process, to present lessons in a more dynamic, interactive and enjoyable way. The hypermedia technology reached its maturity and it is possible to use it to transmit all kinds of knowledge. It is up to the teacher to turn his or her course more attractive to the students and in this way taking profit of the great attraction made by computers and the new hypermedia technologies like WWW and Internet.

Statistics is a discipline that everybody knows that is not popular among college students but that with some efforts and these new tools we can make a lot more understanding and enjoyable. In this article we are presenting a hypermedia system that intends to aggregate the popularity of the Internet and WWW with facilities specifically designed to teach it. In this way we are collaborating do reduce the great waste of time and money represented by the large number of reprovations in this courses.

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